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TSUNAMI NEWSLETTER is published by the International Tsunami Information Center to bring news and information to scientists, engineers, educators, community protection agencies and governments throughout the world.

We welcome contributions from our readers.

The International Tsunami Information Center is maintained by the U.S. National Oceanic and Atmospheric Administration for the Intergovernmental Oceanographic Commission of the United Nations Educational, Scientific and Cultural Organization. The Center's mission is to mitigate the effects of tsunamis throughout the Pacific.

MEMBER STATES

Present membership of the International Coordination Group for the Tsunami Warning System in the Pacific comprises of the following States:

CANADA
CHILE
CHINA
COLOMBIA
COOK ISLANDS
ECUADOR
FIJI
FRANCE
GUATEMALA
INDONESIA
JAPAN
KOREA (REPUBLIC OF)
MEXICO
NEW ZEALAND
PERU
PHILIPPINES
SINGAPORE
THAILAND
UNITED KINGDOM (HONG KONG)
USA
USSR
WESTERN SAMOA

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FEATURE

Automation Highlights of the Pacific and Alaska Tsunami Warning Centers

By Thomas J. Sokolowski (March 21, 1983)

(Due to the length of this report, only the first part of the paper is presented here. The remainder of the report will be published in the next issue of the Newsletter.)

INTRODUCTION

This report will trace the automation highlights of the Tsunami Warning System (TWS) at both, the Pacific Tsunami Warning Center (PTWC) in Hawaii and the Alaska Tsunami Warning Center (ATWC) in Alaska. It will not include hardware procurement and configuration, or computer design, by the Pacific and Alaska Regions. The TWS automation will cover chronological developments at the PTWC and the ATWC, going from completely manual TWS operational systems to ones which use computers. Although the automation of the TWS is not finished, major areas have been addressed, with techniques developed and implemented. In the future, the accomplished automation developments will be continually monitored, refined, improved, regrouped, and retested.

The PTWC automation will cover the period from 1966 to 1981, and the ATWC from 1979 to the present time. The PTWC automation is less detailed than that of the ATWC since numerous detailed memoranda and reports have been written concerning the automation of the PTWC. The ATWC automation includes detailed topics ranging from manual operations, selected for automation, to a system which locates earthquakes and processes its data automatically. Past automation reports and selected papers are listed in the bibliography and referenced in this report.

PACIFIC TSUNAMI WARNING CENTER AUTOMATION FROM 1966 - 1981

The automation of the PTWC, formerly the Honolulu Observatory, began in 1966 with the publication, "Automatic Epicenter Locations from a Quadripartite Array," (Sokolowski & Miller). This work showed that a computer and a quadripartite seismic net on Oahu, Hawaii, could improve the PTWC TWS services. Initial techniques were developed to determine earthquake locations rapidly. Since these techniques required the use of a computer, efforts were made to obtain a second generation computer for the PTWC, but were unsuccessful. Several more unsuccessful attempts were made during the period from 1966 to 1970.

In 1973, the PTWC was transferred to the National Weather Service (NWS). Attempts were made through memo's, reports, and presentations, during the period between August 1973 to July 1974, to begin automating the PTWC operational TWS procedures. In June 1974, the Pacific Regional Director permitted a feasibility study to automate the Center's operational procedures and appointed an AUTO HO Committee to plan and implement this automation. Initial funding for this study was provided

by both the Pacific Region Headquarters (PRH) and the National Weather Service Headquarter (NWSHQ). The AUTO HO committee consisted of Sokolowski from PTWC, Chairman; G. Harger and M. Keyes from PRH. In later years, the committee membership grew to include other Region individuals whose expertise would enhance the automation project. This included Arthur Tanimura, a computer systems specialist, who joined the committee in 1977. Details of the initial automation plan can be found in the AUTO HO Report dated December 1974.

Since a remote time-share computer would suffice for this study, R. Eppley, M. Keyes, and T. Sokolowski surveyed various Honolulu vendors to determine who could best satisfy the PTWC requirements for leased computer time and peripherals. Computer time was leased from Kentron Inc., who had a HP 2000F time-share computer located 25 miles from the PTWC. The automation peripherals (ASR 33, CRT, cassette, printer, etc.), used at PTWC to interact with the remote time-share computer, were leased from the Hawaiian Telephone Co. The remaining required equipment were purchased by the PTWC. The yearly expenditures for the entire automation package was approximately $8000. Details of this stage of the PTWC automation are contained in memo's, the Feasibility Proposal dated July 1974, the Proposal for the Continuation of Automation of the Tsunami Warning System dated January 1975, and the AUTO HO Reports dated December 1974 and July 1975.

A system analysis of the PTWC was done to determine which parts of the TWS manual operational procedures could be automated and their priorities for automation. The analysis, planning, software coding, and final implementation were done in-house thus eliminating costs for help outside of our organization.

The PTWC automation was planned to first improve the weakest parts of the TWS procedures. This planning also included numerous in-house presentations, lectures, etc., to introduce the PTWC staff to the use and benefits of a computer. This staff-computer interaction permitted a smooth transition in going from a manual TWS to one using a computer.

The TWS message composing area had the highest priority for automation. These messages, disseminated on several different teletype systems, consisted of seismic and tide data requests, watches and their supplements, warnings with supplements, press release, and various other miscellaneous messages. Manual preparation of these messages, using a spare off-line teletype machine were not timely and the system was prone to errors. Some messages, such as a warning, contained over 100 pieces of data, took about 45 minutes to prepare manually, and required at least two people to complete.

In 1975-76, the communications functions were automated and the computer produced TWS messages for all of the earthquake/tsunami investigations and watch/warning issuances. This automation considerably reduced the time required to produce these messages and increased the accuracy of the disseminated information and data. Also, these messages could be produced by one operator with almost no manual data manipulation.

With the addition of a high speed paper tape punch, the time required to produce a watch or warning message was further reduced to about 5 minutes. The automation was successful, with easy to use equipment, and became an integral part of the TWS procedures. Details of this automation are given in the AUTO HO Report dated July 1975. After automating the communications at the PTWC, the automation techniques development turned towards earthquake data processing.

The manual PTWC earthquake location scheme involved a triangulation method, using seismic P wave arrival times from several Pacific sites and a large 32" diameter world globe. The P travel times were repeatedly adjusted until there was an approximate intersection of arcs from each of the site's data. Using this process, the time required to locate an event ranged from 5 to 20 minutes. In 1976, Sokolowski went to the National Earthquake Investigation Service (NEIS) to review their interactive earthquake location scheme and to determine applicability to the PTWC requirements. They were using Geigers algorithm, which was programmed for a Xerox 9000 computer to calculate earthquake locations. The fundamental algorithm was applicable to the PTWC operations and a listing of their software was obtained. The software was converted from Fortran to a Basic computer language compatible with Kentron time-share computer. The software was further modified so that the data and computer equipment at the PTWC, could be used interactively with the remote computer to implement the TWS procedures. This interactive earthquake location software was completed and implemented in 1976. This automation resulted in more accurate earthquake locations, in a matter of seconds, and was easily executed by an operator. The software was integrated with the communication software producing a complete working unit. This was an improvement over the past manual methods, but the PTWC was still dependent on obtaining P wave data, from external sources, for manual entry into the computer.

Attempts were made to have real-time data telemetered to the PTWC from external sources which would give PTWC the ability to adequately locate any large Pacific earthquake in a timely manner. A study was conducted using 29 assumed epicenters around the Pacific Basin and 6 mid-range sites, such as Midway, Tahiti, Canton Is., Kwajalein, Johnston Is.,etc. Earthquake locations were computed using simulated data from each of these sites. The results of this study showed that this net could produce timely and adequate earthquake parametric (latitude, longitude, magnitude, etc.) computations to enhance the TWS services. Details concerning this study, telemetry costs, communication routings, etc., are given in the AUTO HO Report dated December 1974, and in the study, "PTWC Extended Seismic Telemetry Net," dated October 1977.

In 1977, the automation had progressed as far as it could using a remote time-share computer at Kentron. During this time, the PTWC investigated other computers and automation equipment, such as the Pearl Harbor Navy time-share computer, a Honolulu weather forecast office computer, a stand-alone CRT, floppy disk, etc. None of these other options enhanced the automation of the PTWC. The PTWC also considered the next major effort, which was to process local and teleseismic

earthquake data on-line and in real-time using a dedicated on-site computer at the PTWC.

At that time, S. Stewart from the Geological Survey in Menlo Park, published a paper concerning real-time earthquake epicenter calculations. He used a CDC 1700 computer which was dedicated for automatic detection and location of local earthquakes. R. Eppley and T. Sokolowski visited Menlo Park to determine if Stewart's work was applicable to the TWS automation efforts. It was partially applicable and efforts were initiated to obtain an on-site computer at the PTWC. Details of this are in the AUTO HO report dated June 1977.

In October 1977, a computer review meeting was held at the NWSHQ. Those present were Flittner, Sikorski, Eppley, Spaeth, Tanimura, and Sokolowski. The main topics were computer requirements for both the PTWC and ATWC, computer design and hardware configuration, and a generalized backup for both the PTWC and ATWC. A common scenario for both Centers included: automatic earthquake locations and sizes, in real-time and on-line, with the results available for a duty geophysicist's review; an easy method to refine the automatic results; and, easy implementation of the remaining Tsunami Warning procedures. The General Electric (GE) time-share system, located on the continental U.S., was chosen as an alternate system for both Centers.

In latter part of 1978 and for some time later, parts of a Data General (DG) S230 computer and various peripherals arrived at the PTWC and were integrated into a computer system. Software conversions began in September 1978, and for the next five months, all software that existed on the Kentron computer were converted to function on the PTWC DG system. Most of the logic for the communications software were redone due to the computer language change (Basic to Fortran). Similar earthquake location and message generating schemes were programmed for the backup GE time-share system.

The major PTWC operational programs functioning on the DG S230 were:

1. ONE - Master control program which permits an operator to select a particular message generating program or an epicenter location program.

2. SEIS - Generates about 30 seismic messages requesting "P" data from various sites throughout the Pacific Basin.

3. TIDE - Generates about 50 messages requesting tide data, for particular water wave arrival times (ETA), from various tide stations throughout the Pacific Basin.

4. WARN - Generates watch and warning series messages and their supplements for large earthquakes.

5. PRESS - Generates a Press Release message concerning earthquake/ tsunami investigations.

6. QUAKE - Computes teleseismic earthquake locations and other parameters.

7. TTYMSG - Generates various routine and other messages required in the day-to-day operations and during an earthquake/tsunami investigation.

8. STATST - Generates monthly communication test messages to determine one way stations to station transmission times.

9. DISTST - Generates monthly communication test messages to determine two way station to station transmission times.

The next step would have been on-line real-time local and teleseismic earthquake processing, but priorities were changes in an attempt to eliminate the ASCII to Baudot conversions for the DCS teletype. This introduced a delay in the PTWC automation.

From January to March 1981, the RDOS operating system was changed to the AOS system. During that same period, all staff members were taught some basics of AOS, backing up the system, programming, etc., by Tanimura and Sokolowski. In March, Sokolowski was transferred to the ATWC, and therefore, the remainder of this report will concern the automation highlights at the ATWC.

NEWS EVENTS

Earthquake of December 19, 1982 Generated Minor Tsunamis

An earthquake measuring 7.4 in the Richter scale occurred in the Kermadec Islands on December 19, 1982 and generated minor tsunamis recorded at the following tide gauge stations:

Papeete, Tahiti - 15 cm
Pago Pago, American Samoa - 9 cm
Honolulu, Hawaii - 4-5 cm
Kailua-Kona, Hawaii - 6 cm

March 18, 1983 Earthquake and Tsunami in the New Guinea-Solomon Islands

On March 18, 1983 an earthquake of a magnitude of 7.8 on the Richter scale, struck the New Guinea-Solomon Islands area near New Britain Is. Normally, an earthquake of such a magnitude would cause serious damage. However, only minor damage was reported within 200 km radius of the epicenter. The only major structural damage was to a concrete pier at Muliana on the East Coast of New Ireland which collapsed completely. A minor tsunami with a maximum double amplitude of 20 cm (trough to crest) was recorded at the Rabaul Harbour tide gauge station.

Earthquakes

Yemen - December 13, 1982

A major earthquake of a 6.0 magnitude in Yemen caused extensive destruction of housing leaving a death toll of about 3,000. Over 1,500 were injured, 700,000 left homeless, and 325 villages either damaged or destroyed. The worst hit village was Jahran, 63 miles south of the capital, Sanaa, with 335 dead.

Afghanistan - December 16, 1982

A strong earthquake, measuring 6.6 on the Richter scale, hit the Hindu Kush region of Afghanistan, 160 km north of Kabul. At least 500 were killed, more than 3,000 were injured and 7,000 homes were destroyed.

Indonesia - December 25, 1982

An earthquake of 6.3 magnitude killed 13 people, injured nearly 400 and damaged about 1,900 homes and 120 public buildings on the East part of Flores Island in Indonesia. The Flores Island is about 1,600 km east of Jakarta. Further tremors were recorded on January 14 in several of the surrounding areas. No tsunami was reported.

Mexico - January 24, 1983

A strong earthquake, felt throughout South Mexico, occurred about 30 km east of Tehuantepec, in the Oaxaca Province. It registered 6.6 on the Richter scale. Only minor damage was reported in Mexico City.

Colombia - March 31, 1983

At least 200 people were killed in the City of Popayan, Colombia, 235 miles southwest of Bogota, when an earthquake of magnitude 5.5 struck. More than 3,000 homes and other buildings were destroyed. The Roman Catholic Cathedral collapsed on some 200 worshippers, killing at least 15 and burying as many as 100 people. 500 were reported injured. In the two nearby towns, Piendamo and Cajibio, about a hundred buildings were destroyed. 15 were dead and 50 injured.

California, U.S. - May 2, 1983

A powerful quake, registering 6.5 on the Richter scale, occurred in Central California and caused $25 million damage in the town of Coalinga. 47 people were injured but no fatality was reported. 300 of the 2,600 homes suffered major damage.

Director Attended Communication Workshop

The fifth annual conference of the Pacific Telecommunications Council assembled in January 16-19, 1983 in Honolulu, Hawaii to examine new developments and new hopes for telecommunications serving the Pacific Region. The secretary-general of the International Telecommunications Union, Mr. Richard E. Butler opened the conference. The United Nations General Assembly has declared 1983 as the World Communications Year in order to spotlight the importance of Communications to the development process of nations.

Dr. George Pararas-Carayannis, ITIC Director, attended the conference and participated in seminars focusing on improvements in Pacific Communications which could have applications to the Tsunami Warning System in the Pacific. A principal discussion of the conference centered around ways to serve individual parts of the vast Pacific region. Specifically, a group from Japan's Research Institute of Telecommunications and Economics laid out a plan for a regional satellite operation that would provide various types of service to the countries in the area. INTELSAT reported of potential satellite services for Pacific islands making use of existing technology and global satellite services. A study by the Public Service Satellite Consortium suggested that the greatest telecommunication need in Pacific island nations is for telephone and data links. Concluding conference round table discussions brought together varying views on the potential directions for further development of both high density and low density telecommunications facilities in the Pacific. Dr. Pararas-Carayannis was gratified to see that Communications in the Pacific are receiving a great deal of attention and long term benefits to the Tsunami Warning System will derive from such efforts.

Director Gave Lecture on Tsunamis

The Maritime Center at the Aloha Tower in Honolulu is sponsoring a marine-oriented lecture series to the public.

Dr. George Pararas-Carayannis was invited to participate by the Maritime Center and gave a lecture on Tsunamis on April 21, 1983 at the Honolulu Chamber of Commerce.

Tsunami Warning System (TWS) Coordination Conference 1983 to be Held in September 1983

Every two years since 1975, U.S. National Weather Service Headquarters has held a TWS Coordination Conference in either Anchorage or Hawaii. The 1983 conference will be held in the week of September 12 in Anchorage. Attendance to the conference will be representatives from National Weather Service Pacific, Alaska, and Western Regions and other agencies including Federal Emergency Management Administration (FEMA), National Ocean Service (NOS), and United States Geological Survey (USGS), etc.

The purpose of the conference will be to coordinate matters related to the operation of the Alaska and Pacific Tsunami Warning Centers, and of the National and Regional Tsunami Warning Systems in the USA.

Gerry Dohler Returns to Canada

Gerry Dohler, Associate Director of the International Tsunami Information Center will return to Canada at the end of June after serving for one year as Associate Director of ITIC in Honolulu. For the last six years he has also served as the Chairman of the International Coordination Group for the Pacific Tsunami Warning System in the Pacific (ITSU), and has provided leadership to this program. During his stay in Honolulu Gerry worked on several problems involving the tsunami program -- specifically, coordinating the writing of the Master Plan on the Tsunami Warning System. He will return to his post as Director of the Chart Production Branch, Canadian Hydrographic Office in Ottawa, but will continue to work with tsunami related programs in his capacity as Chairman of ICG/ITSU.

The Intergovernmental Oceanographic Commission is planning, during October 1983, a tsunami oriented mission to western Pacific countries and Gerry has been asked to participate.

UNESCO - IOC - ITSU

ITSU-IX Meeting in Honolulu

The Ninth Session of the International Coordination Group for the Tsunami Warning System in the Pacific (ICG/ITSU-IX) will be hosted by the United States of America on 13-17 March 1984 in Honolulu, Hawaii. The meeting will take place at the Jefferson Hall of the East-West Center. Arrangements are being made for the meeting participants to visit the Pacific Tsunami Warning Center (PTWC) and gain first hand experience with the Center's facilities and procedures. This is the second meeting in Hawaii in approximately 18 years. It was in 1965 that the first International Tsunami meeting was held in Honolulu and which established ICG/ITSU and the International Tsunami Information Center (ITIC). An agenda for the IX Session will be prepared by the IOC Secretariat and a summary will be published in a future issue of the ITIC Tsunami Newsletter.

List of National Contacts of ICG/ITSU

The following is a list of National Contacts of ITSU members on file in the ITIC office. Please inform ITIC if there are any changes.

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Summary Report of the Sixteenth Session of the Executive Council Published

The Sixteenth Session of the Executive Council was held on November 2, 1982 in Paris. Of particular interest related to Ocean Services and the Tsunami Warning System was the report on the proposal on the "Mitigation of the Tsunami Hazard in the Pacific" which was submitted to UNDP, but which still awaits consideration. The IOC Secretariat also reported that two missions are being planned, one to the Eastern Pacific and one to the South Pacific, to formulate project proposals for further negotiations with UNDP and bilateral donor agencies. Summary report of the session is now available from UNESCO/IOC.

NATIONAL AND AREA REPORTS

Improved Communications in Some of the Pacific Islands May Aid Transmission of Tide/Tsunami Data

Telephone communications via satellite are now available to Palau, Ponape, Majuro and will be available to Truk, Kosrae, and Yap in June-July 1983.

Communication to these locations will be greatly improved when compared to using the common-user HF radio links with Saipan, which in turn, interface the traffic with Guam via the Troposheric Scatter Wave System. The NWS is planning to leave teletype channels on these new satellite circuits within the very near future. With this latter improvement there is the possibility of transmitting data on a real time basis through automated systems and also perhaps data by fascimile transceiver via the voice telephone channels. Transmission of tide or tsunami data through both of these means are now being investigated.

Tsunami Stations Inspection

The Pacific Tide Party personnel completed the inspection for the following stations:

Honolulu, Hawaii	8 Jan 1983
Hilo, Hawaii	13-18 Jan "
Kahului, Hawaii	24-28 Jan "
Wake Island	3 Feb "
Nawiliwili, Hawaii	9-12 Feb "
Johnston	15-19 Feb "
Midway	18-24 Feb "
Kwajalein	19-22 Feb "
Truk	25 Feb - 2 Mar 1983
Pago Pago	2-8 Mar 1983
Guam	2-8 Mar "
Fort Point	23-24 Mar "

ANNOUNCEMENTS

United States - Japan Tsunami Workshop Held on May 12-13, 1983

A U.S.-Japan Tsunami Workshop in coordination with the 15th Joint Meeting of U.S.-Japan Panel on Wind and Seismic Effects was held on May 12-13, 1983 in Ibaragi, Japan. U.S. participation was sponsored by the U.S. National Science Foundation. The principal objective of the workshop was to enhance researches and studies on tsunamis in the U.S. and Japan through the exchange and discussion of views and opinions on current status, present problems and future directions of researches and studies on tsunami by bringing together scientists and engineers actively pursuing tsunami studies in both countries. Topics discussed included:

A. Tsunami behaviour in coastal water and on land -- this includes water velocities, flooding, runup, floating objects, etc.

B. Nonlinearity problems of tsunami -- this deals with phenomena in which nonlinar effects are essential such as mach stem, bores, certain shallow water effects.

C. Mesh consideration in numerical work -- this includes appropriateness of various grids for deep and shallow water, mesh refinement, irregular meshes, etc.

D. Finite difference vs. finite element methods.

E. Tsunami protective measures in Japan and U.S.

Post-workshop tours to various research institutions were conducted.

The 3rd Conference on Coastal and Ocean Management, June 1-4, 1983

The above mentioned conference will be held in San Diego, California. The overall theme is "Resolution of Coastal Conflicts through Education, Understanding and Management Techniques." It will offer an opportunity for participants to discuss improved jurisdiction arrangements, conservation and design considerations, enforcement policies, investigation and planning methods, data collection, and government financing. For additional information contact: Coastal Zone 83, P.O. Box 26062, San Francisco, CA 94126

The 17th Law of the Sea Conference to be held in Oslo, Norway

July 13-16, 1983 marks the dates for the above mentioned conference. The Law of the Sea Institute provides a neutral forum for the discussion of a wide range of issues pertaining to the uses of the sea and

its resources. Through its conferences and publications the Institute disseminates information about decisions, institutions and arrangements, and encourages communication and research among those concerned with all aspects of the exploration and exploitation of the oceans. The principal emphasis is on the international law of the sea as it may be expected to evolve in the future. The theme of the 17th Conference is an evaluation of the outcome of the 1982 Convention on the Law of the Sea. The Conference will assess the Convention's significance and its impact at sea and on land, its shortcomings and what remains to be done, the prospects for the future. For further information, please contact: Scott Allen, Associate Director, Law of the Sea Institute, University of Hawaii, Honolulu, HI 96822.

Project on Collection and Evaluation of Data on Earthquake Light Phenomena

Dr. Peter Hedervari of the Center for Cosmic and Terrestrial Physics in Hungary invites everyone who is interested in the above mentioned project to participate. The aim of the project is the collection and analysis of old, historic, and recent Earthquake Light data from all over the world, for better knowledge of their nature and origin. As the data are received, it will be published from time to time in various journals.

Reports on other strange events related to earthquakes such as unusual fog, mist, air-shock, abrupt change in air pressure, sudden cooling or warming of the atmosphere, restless behaviour of animals prior to the shock, gas and mud eruptions, strange odor, occurrence of earthquake-fountains, visible waves on the ground, magnetic disturbances, etc., would also be very much appreciated.

Reports on EQL should include the following data: date/year, month, day, hour and minute of the shock, epicentral coordinates, epicentral intensity in terms of the 12 degrees scale, Richter /M/ or body wave /m/ magnitude, focal depth; place of the EQL in relation to the epicenter/distance from it and the direction relative to the place of the epicenter, exact time of occurrence prior to the shock, or during the quake, or else after it, and place of the light relative to the surroundings e.g. on the soil, within a cave or a mine, along the slope of a hill or mountain, near to an active volcano or in a non-volcanic area, near to a seismoactive fault, in the air, but near the ground, or high in the air, between or above the clouds, on the surface of the water of a river, lake, sea or ocean, beneath the level of the water or on the crest of the arriving normal or tsunami waves, or well over the water, etc. The duration, measure, estimated dimension, colour and intensity of the EQL should also be noted.

All correspondence should be sent to Dr. Peter Hedervari, c/o Georgiana Observatory, H. 1023 Budapest II., Arpad fejedelem utja 40--41, Hungary.

"Proceedings, Tsunami Symposium, Canberra, December 1979" now Available

The above proceedings, edited by Dr. R. D. Braddock of the Griffith University, Australia, are now available. The publication contains papers and abstracts of papers which were offered, or presented at the Symposium held from December 3 through December 15, 1979 at the Australian National University, Canberra, Australia. Requests for the publication should be made by writing to: Dr. R. D. Braddock, School of Australian Environmental Studies, Griffith University, Nathan, Queensland, Australia 4111. Postage will be free via sea mail.

Tsunami Data Received from China

The People's Republic of China's National Bureau of Oceanography has sent the National Geophysical Data Center tidal wave mareograms for 1960 to 1980 for two stations. This is the first receipt of Chinese copies of an analog tidal wave record and is part of the continuing exchange between China and U.S. under a protocol agreement.

New Publications Available from the National Geophysical Data Center

United States Earthquakes, 1980

This publication provides a summary of all earthquakes which occurred in the United States and nearby territories during 1980. It also includes a summary of felt and damage data reported for each earthquake, a list of earthquakes by State, results from local seismic networks, information on crustal movements, detection by space technology, tsunamis, principle earthquakes of the world, and strong-motion seismograph data. Price: $7.00

New Catalog of Strong Earthquakes in the U.S.S.R. from Ancient Times through 1977

This catalog is a translation of the Russian publication which provides comprehensive study of earthquakes in the Soviet Union. The translation is divided into four major sections: methodology, tables of earthquakes for 14 regions of the USSR, felt information for the major destructive shocks in these regions, and an extensive bibliography. It also includes an index to places mentioned in the text and the tables.
Price: $ 25.00 (book format, Report SE-31)
100.00 (digital magnetic tape)
Inquiries should be directed to: World Data Center A for Solid Earth Geophysics, National Geophysical Data Center, NOAA, Code D622, 325 Broadway, Boulder, CO 80303

Strong Motion Data from Japanese Earthquakes

This contains 177 component plots of uncorrected and corrected Japanese ground-motion accelerograms from 53 earthquakes recorded between 1956 and 1978 at 42 sites. These data are particularly valuable because of the subduction zone environment where they were recorded. The coastal region of Japan is tectonically different from the western United States and similar to offshore and coastal southern Alaska where strong motion data are sparse.
Price: $ 20.00 (book, Report SE-29)
200.00 each tape/$300.00 for two-tape set (Vol I/uncorrected, Vol II/corrected)

Earthquake History of the United States (Through 1980)

This is a reprint of Publication 41-1, Earthquake History of the United States, including an updated supplement which covers the years 1971-1980. It summarizes earthquake events from historical times through 1980. The report includes descriptions of earthquakes of Modified Mercalli (MM) intensity V and above (in California, intensity VI and above). For the purpose of listing and describing the earthquakes, the United States has been divided into nine geographical regions, determined with regard to natural seismic areas. Each section has a summary table of precise locations, times, areas, intensities and references.
Price: $ 8.50 (soft cover)
12.00 (hard cover)

All of the above publications can be ordered from:
National Geophysical Data Center
NOAA, Code D62
325 Broadway
Boulder, CO 80303

New Pamphlets on Tsunami Available

Two new pamphlets, one on Tsunami in Alaska and the other on the West Coast of United States, were produced by the Alaska's Division of Emergency Services in cooperation with the Alaska Tsunami Warning Center. The pamphlets provide general information on tsunamis, the warning system, differences in watch and warning, local and Pacific-wide tsunamis.

Tsunami Society Publish Monograph and Journal

The first issues of the Tsunami Society Monograph Series and the Natural Sciences of Hazards: The International Journal of the Tsunami Society have been published.

Sample complimentary copies of the Journal and of the Monograph Series were distributed by ITIC as supplements to the ITIC Newsletter as it was

felt that these publications were of great interest. A cover letter accompanied the reports clarifying that the Tsunami Newsletter is an ITIC publication provided free-of-charge to interested parties, but that future publications of the Tsunami Society publications will be sent directly by the Tsunami Society to its members only.

For future issues of these journals and for membership, please contact: The Tsunami Society, P.O. Box 8523, Honolulu, Hawaii 96815, U.S.A.

The Tsunami Society will hold its 2nd International Conference in Las Vegas, Nevada in June 1984

The Tsunami Society plans to hold its second biannual international conference on June 17-23, 1984 at the University of Nevada in Las Vegas, Nevada, U.S.A. The conference will not be restricted only to tsunamis but will include discussions and presentation of papers on the Physics of other natural and man-made hazards.

Anyone interested in participating please send abstracts of papers or application for attendance to the Tsunami Society, P.O. Box 8523, Honolulu, Hawaii 96815, U.S.A.

New Journal to be Published by the Research Committee on Disasters

During the World Congress of Sociology in Mexico City in August 1982, the Research Committee on Disasters was established. The Committee welcomes memberships from anyone interested in the social study of disasters; political scientists, anthropologists, disaster planners, emergency organization personnel, government officials involved in emergency planning and management, civil defense directors, etc. Membership dues are: $20. per year for individuals and $70. per year for organizations. Members will receive International Journal of Mass Emergencies and Disasters, and the Unscheduled Events. The journal is concerned with the social and behavioval aspects of relatively sudden collective stress situations usually called mass emergencies or disasters. It also includes publications of results of scientific research, theoretical and policy studies, reports of planning problems, as well as accounts of floods, earthquakes, fires, etc. Three issues will be published per year. The Unscheduled Events will bring three kinds of news from the membership: Short notes about the members; lists of the member's latest publications including abstracts; and presentations of on-going research projects. Library subscription to the journal is $48. per year and $22. per year for the Unscheduled Events (3 issues a year). For further information contact: Jan Trost, Uppsala University, P.O. Box 513, S-751 20 Uppsala, Sweden.

ABSTRACTS

Disaster Prevention and Mitigation: A Compendium of Current Knowledge, Volume 8 - Sanitation Aspects

United Nations Disaster Relief Coordinator, 1982, 75 pp. Single copies are free. Available from R.M. Zoubeidi, UNDRO Liaison Director, Room 2535, United Nations, New York, NY 10017

Prepared in cooperation with the World Health Organization, this monograph deals mainly with disaster conditions developing nations are likely to experience. Part "A" addresses problems associated with water supply and waste disposal, such as water storage and treatment in emergency camps, and organizational procedures to ensure adequate sanitary relief measures. Part "B" considers postdisaster control of diseases transmitted by arthropod or rodent vectors. The selection of appropriate insecticides and rodenticides is discussed, together with an examination of equipment and techniques for applying these chemicals. The monograph points out that the opportunity in the disaster health field is to prevent or reduce the risk of damage to the sanitary infrastructure of communities exposed to extreme natural hazards.

[Natural Hazards Observer, November 1982]

The Tsunami Response of the Hawaiian Islands

G. T. Hebenstreit and R. O. Reid
Texas A & M Univ., College Station
Department of Oceanography

A linear, long-wave, finite difference model is applied to the Hawaiian Island chain to determine the spectral response at the islands for tsunamis incident from any one of a broad range of directions. The model employs an improved radiational condition for scattered waves. The excitation is in the form of a plane wave form of prescribed direction, but having a broad band spectrum of frequencies or periods typical of the normal range of tsunami events. The island boundaries are modeled as totally reflecting seawalls, with no allowance for non-linear runup, dissipative effects or subgrid scale embayments. The response ascertained in this study reflects the large-scale effects of bathymetry and island configuration, including partial trapping of energy by combined effects of refraction and reflection.

Earthquake Public Information Materials: An Annotated Bibliography

Southern California Earthquake Preparedness Project
1982, 47 pp. Single copies are available at no cost from the Southern California Earthquake Preparedness Project, 6850 Van Nuys Boulevard, Suite 110, Van Nuys, CA 91405-4660

One of the tasks of the Southern California Earthquake Preparedness Project is to inventory available public information material and to design a program to disseminate information on earthquake safety to the public. This bibliography is a first step toward that goal. Annotations are presented for books, booklets, pamphlets and brochures that are available to the public from many sources. Most are published by government offices and agencies and are free or cost a slight amount. The materials selected for inclusion in the bibliography provide mostly non-technical explanations that lay persons can understand. The scientific materials included are also comprehendible to public readers.

[Natural Hazards Observer, January 1983]

Disaster Planning for Local Government

Roger E. Herman
New York: Universe Books
381 Park Avenue South
New York, NY 10016

(1982, 138 pp, $15.00)

This publication is a practical, easy to use guide for small communities that cannot afford to maintain a full-time professional staff for disaster planning and preparedness programs. Activities and recommendations outlined can be implemented by local officials without outside consultants or temporary help. Elements of disaster planning that receive the most attention include preparation of an emergency operations plan, identification of the persons most capable of preparing a disaster contingency plan, operation of an emergency center, the utilization of disaster training programs, keeping a completed plan in good working order, and the establishment of coordination networks with other disaster organizations.

[Natural Hazards Observer, January 1983]

Development of a Tsunami-Flooding Model Having Versatile Formulation of Moving Boundary Conditions

Carter H. Lewis III and W. M. Adams
University of Hawaii
Honolulu, Hawaii

An explicit, split-step, midpoint-leapfrog, finite-difference analog to the nonlinear, shallow-water, Navier-Stokes equations is developed for application to the modeling of tsunami-flooding. A homogeneous, incompressible, inviscid fluid subject only to the forces of gravity and bottom-friction is assumed. Vertical advection of momentum is permitted.

A theoretical stability-analysis is performed, yielding constraints on the permissible space- and time-steps necessary to insure a stable solution. It is concluded that the finite-difference scheme is a consistent approximation to the governing differential equations when the stability requirement is observed.

An evaluation of the most common numerical moving-boundary treatments shows each to be restricted by assumptions made regarding special conditions existing in the neighborhood of the moving boundary. As a result, a heuristic flooding scheme is developed which allows the prognostic equations to be applied without prejudice uniformly across the entire computational grid.

Careful comparison of experimental results with a known, analytical solution is essential to produce a verified model. Model performance is appraised by recording all results as a motion picture, then viewing the results to detect computational anomalies and to assess spatial and temporal coherency. Various formulations of the nonlinear advection term are tested for stability in this fashion, and effects produced by filtering are examined.

Parameters of Tsunami Waves in the Source

N.P. Mirchina, E.N. Pelinovsky & S.Kn. Shavratsky
Institute of Applied Physics
Academy of Sciences of the U.S.S.R.
Gorky, U.S.S.R.

Correlation relations of the displacement and tsunami wave-length in the source to the earthquake magnitude have been obtained that are useful for tsunami wave calculations.

[Natural Sciences of Hazards: The International Journal of the Tsunami Society, October 1982, B1-B7]

A Model of the 1975 Hawaii Tsunami

Charles L. Mader, Robert E. Tangora & B.D. Nicols
University of California
Physics of Natural Hazards
U.S. Department of Energy

The Hawaii tsunami of November 29, 1975 was calculated using a linear shallow-water-wave code assuming various source models. It was also modeled using a three-dimensional code SOLA-3D for solving the incompressible, nonlinear Navier-Stokes equations. The observed tsunami wave profile near the source was a second wave larger than the first wave. This could be assuming a step function for the source motion. The observer wave profile may be approximated by the nonlinear calculation without a source motion step function.

[Natural Science of Hazards: The International Journal of the Tsunami Society, October 1982, C1-C8]

Nonlinear and Dispersive Effects for Tsunami Waves in the Open Ocean

N.R. Mirchina & E.N. Pelinovsky
Institute of Applied Physics
Academy of Sciences of the U.S.S.R.
Gorky, U.S.S.R.

The influence of nonlinear and dispersive effects for tsunamis, that occurred near the Pacific shore of the USSR and Japan, are performed. It is shown, that these effects can be essential for tsunami waves crossing the Pacific Ocean.

[Natural Sciences of Hazards: The International Journal of the Tsunami Society, October 1982, D1-D9]

Numerical Modeling of Tsunami Flooding

W.M. Adams & C.H. Lewis, III
University of Hawaii
Honolulu, Hawaii 96822

Finite difference programs have been developed for modeling tsunami flooding. Fully centered differences are used. A graphics capability of creating movies showing the results at every time step has been found essential to assure arrival at a believable and correct conclusion. Comparison of output with analytical results, while necessary, does not assure that a program is satisfactory; misuse is not only possible but probable. Most applications documented in the scientific literature allow aliasing in the horizontal interfaces, the vertical interfaces, or both. Smoothing of moving boundary, the shoreline, is necessary to avoid the introduction of spurious high spatial frequencies. It is necessary to see all the computer output--not just the last results.

[Natural Sciences of Hazards: The International Journal of the Tsunami Society, October 1982, E1-E14]

Cylindrical Solutions Passing Through a Focus

E.N. Pelinovsky & Yu.A. Stepanyants
Applied Physics Institute
Academy of Sciences of the U.S.S.R.
Gorky, U.S.S.R.

No Abstract Available.

[Natural Sciences of Hazards: The International Journal of the Tsunami Society, October 1982, F1-F4]

Establishment and Operation of a Tsunami Monitoring Program

George D. Curtis
Joint Institute for Marine & Atmospheric Research
University of Hawaii
Honolulu, Hawaii 96822

An extensive program for real-time and post-event monitoring of tsunamis has been developed and implemented for the Hawaii area. Methodology includes improved deployable instruments, stop-motion photography from many selected locations, real-time photography from the air, and post-event surveys from the ground and air. Use of existing facilities and organizations, and how to cooperate with and coordinate them is described, and equipment is stressed. Application of these techniques to other locales is outlined.

[Natural Sciences of Hazards: The International Journal of the Tsunami Society, October 1982, G1-G12]

The Damaging Shocks and the Earthquake Potential of Greece

A.G. Galanopoulos
Athens, Greece

Considering that parallel lines enveloping a strain energy release graph and running through the beginning and the end of the most active period ever observed in a given region represent lines of maximum and minimum strain energy accumulation, respectively, the vertical distance of them indicates the maximum strain energy that could be released in a single earthquake somewhere in the region.

It was proved in a previous work that the annual rate of strain energy accumulation and the amount of maximum strain energy accumulation, in a region large enough to accomodate the strain energy released in the greatest earthquake ever occurred in the geologic unit to which the region belongs, correspond to earthquake magnitudes that are, respectively, one and two units higher than that of the <<once-per-year>> earthquake.

Consequently, the magnitude of the maximum feasible earthquake in a given region is one unit higher than the earthquake magnitude corresponding to the annual rate of strain energy accumulation, or two units higher than the annual maximum magnitude that has a probability of 63% of being exceeded in one year.

The method of the assessment of the magnitude of the maximum feasible earthquake from the annual maximum magnitude has been tested in a previous work on 2° by 2° geographic cells covering the major area of Greece with a 3-square-degrees mutual overlapping.

In the present work the magnitude of the maximum feasible earthquake was derived for the same area from the magnitude corresponding to the annual rate of strain energy accumulation. Although the magnitude data used in the second case cover a longer period of observation the values derived for the $1/2^0$ equidistant cell centres compare well with those determined by the first method.

Small discrepancies are observed only in regions suffering from intraplate earthquakes with periods of recurrence much longer than one hundred years. The discrepancies overset by adopting the 10% exceedance probability values being one unit higher, for T = 100 yrs and b = 1, than those previously found. Apparently the 37% exceedance probability values hold for continuous seismicity observed in the marginal belts of the Aegean plate, i.e. for interplate earthquakes with return periods not longer than 100 years.

Equipotential lines passing through the magnitude values 7.0, 6.3 and 5.6 corresponding to IX, VIII and VII intensity grades separate the major area of Greece in three zones of seismic hazard. Considering that the highest intensity assigned to the seismic effects produced in the area of Greece by interplate earthquakes of magnitude 7 1/4 and intraplate earthquakes of magnitude 7 1/2 and over are of about the same grade the zones of seismic hazard may be safely used as zones of seismic risk.

[In Greek]

Seismicity Rates in the Kuriles Island Arc, 1963-1979

R.E. Habermann
Cooperative Inst. for Research in Env. Sciences
University of Colorado/NOAA & Dept. of Geological Sciences
(Received August 19, 1981)

The seismicity rates in the Kuriles from the NOAA Hypocenter Data File have been reexamined using new tools and in light of increased understanding of teleseismic seismicity data sets. We have determined that detection capability decreases affected the reporting of events with $m_b \leq 4.6$ in this region during 1967 and 1976. Events whose reporting was affected by these decreases were eliminated from the data set to insure that rate changes which reflect real process changes in the earth were detected.

The rate decrease which was proposed by WYSS and HABERMANN (1979) as a precursor to the February 28, 1973 event in the Kuriles was primarily due to the detection capability decrease in this region at that time. No rate decrease can be clearly recognized before this event if teleseismic seismicity data not affected by the decrease are examined.

The seismicity of the seismic gap between the aftershock zones of the great events of 1952 and 1963 is primarily controlled by events in two regions proposed by WYSS and HABERMANN (1979) as asperities. The southern asperity experienced a period of low seismicity between March

1972 and June 1974. It is likely that this quiescent period was related to the preparation for an event with $M_S = 6.3$ during July 1974.

The northern asperity experienced quiescence between July 1967 and August 1971. This quiescence was terminated without a mainshock and therefore represents a false alarm in attempts to predict earthquakes on the basis of seismicity patterns alone. This decrease is interpreted as an indication of a large scale aseismic slip episode in this region during this time. This episode appears to have been initiated by a stress wave propagating away from the site of the great event of 1963 at a velocity close to 100 km/year. The relative rarity of major earthquakes in the region of this seismic gap (compared to the regions north and south of it) during the last two centuries may be due to the accommodation of relative plate motion by such aseismic events.

[Earthquake Prediction Research 1 (1982) 73-94]

A Preliminary Investigation of Tsunami Hazard

I. Chen Lin & Chi C. Tung

A method for determining tsunami hazard is presented using simple seismological and hydrodynamic models.

The seismological model assumes that submarine earthquakes of the dip-strike type can occur, with equal likelihood, anywhere along a well-defined straight fault and that the site under consideration lies on the perpendicular bisector of and far removed from the fault. The ground dislocation is circular in the horizontal plane, and the vertical offset is uniform. The radius of the circle and the vertical offset are related to seismic moment which is assumed to be random.

The hydrodynamic model is based on linear dispersive wave theory. It is assumed that the earth is flat, water depth constant, and ocean infinite in horizontal extent. The maximum elevation of water surface of the leading wave is related to ground motion characteristics (or seismic moment) and the distance from the site to the source.

The probability of the event that the water elevation at a site exceeds an arbitrary but specified level is then derived and computed. A sensitivity study is performed to determine the importance of various parameters.

[Bulletin of the Seismological Society of America, Vol. 72, No. 6, pp. 2323-2337, December 1982]

Die Simulation Moglicher Tsunamis im Mittelmeer mit dem HN-Modell (The Simulation of Possible Tsunamis in the Mediterranean with the HN-Model)

Reinhard Dressler

No Abstract Available. [In German]

[Mitteilungen des Instituts fur Meereskunde der Universitat Hamburg, No. 23, pp. 11-30, 1980]

PACIFIC TSUNAMI WARNING CENTER

PTWC's Director Visits Warning Center in Palmer

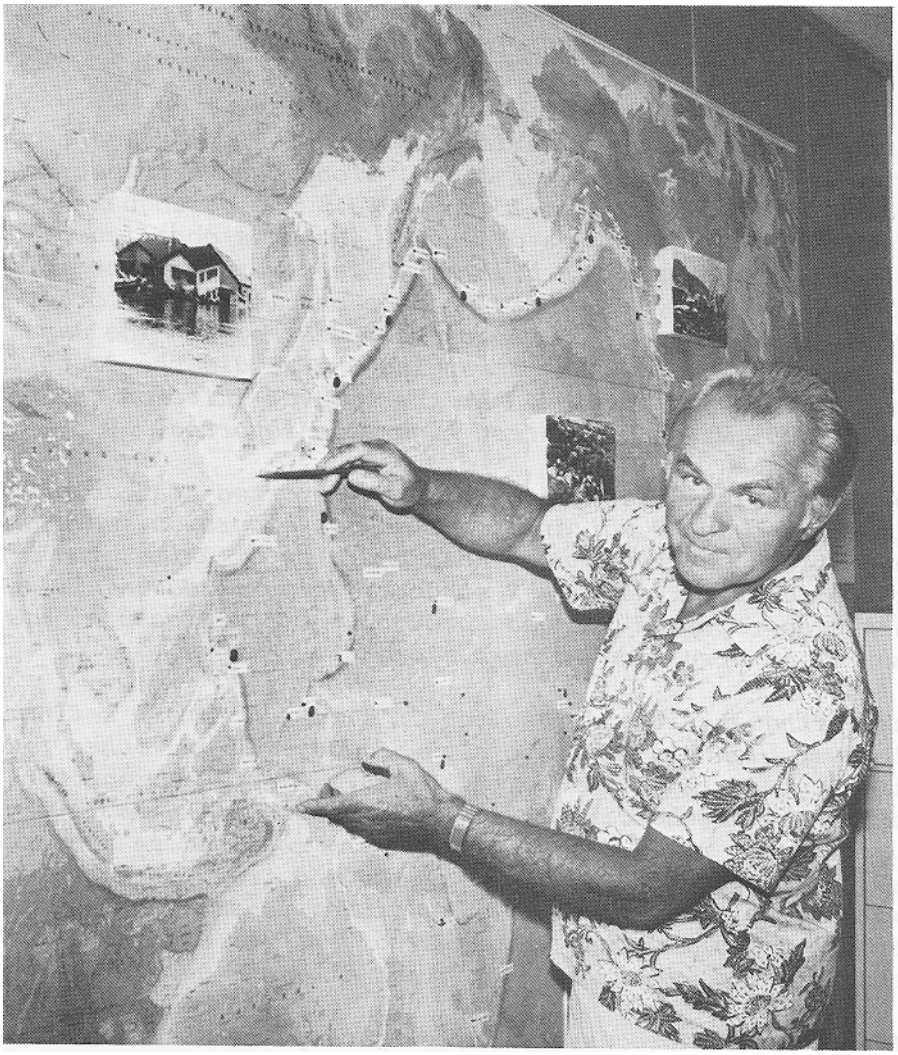
Mr. Gordon Burton, Director of the Pacific Tsunami Warning Center (PTWC) visited the Alaska Tsunami Warning Center (ATWC) in May to familiarize himself with real-time computer technique development for implementation at PTWC. Mr. Burton received instructions and information concerning circuits and data transmission techniques, data collection and calibration techniques, and communications of the Alaska Tsunami Warning Center.

Seismic Summary (October 1, 1982 to Press Time)

EVENT NO.		EVENT	LOCATION	ACTION TAKEN
1982-14		Nov 19 0427 (UT)	Peru 8.7 S	No Press Release
	(PTWC)	6.8	72.6 W	
1982-15		Dec 19 1744 (UT)	Kermadec Islands 27.8 S	Press Release Minor Tsunami
	(PTWC)	7.4	176.5 W	generated.
1983-1		Jan 17 1242 (UT)	Off West Coast of Greece 38.4 N	No Press Release
	(PTWC)	7.0	20.4 E	
1983-2		Jan 24 0818 (UT)	Oaxaca Province, Mexico 15.8 N	Press Release
	(PTWC)	6.6	94.5 W	
1983-3		Jan 26 0444 (UT)	East Pacific Rise 49.0 S	No Press Release
	(PTWC)	6.7	116.0 W	
1983-4		Mar 18 0906 (UT)	Rabaul, New Britain 3.9 S	Watch, Watch Supplement, Watch
	(PTWC)	7.6	153.9 E	Final issued.
1983-5		Apr 3 0250 (UT)	Panama-Costa Rica Border 9.1 N	Earthquake Bulletin issued.
	(PTWC)	7.1	82.8 W	

Visitors to ITIC

Frank Lutz	Our Redeemer Lutheran School, Hawaii
Phil Morin	Pearl City High School, Hawaii
Paul Krumpe	Agency for International Development, U.S. Department of State
Gerald Hebenstreit	Science Applications Inc., Virginia
Fa'auma Seni	American Samoa
Bruce Turner	Pacific Tsunami Warning Center
John & Sharon Davies	National Weather Service, Maryland
Klaus Wyrtki	Dept. of Oceanography, University of Hawaii
T. S. Murty	Dept. of Fisheries & Oceans, Canada
Sharon Arenz	Honolulu, Hawaii
Jan Matsumoto	Office Things, Inc.
Eric Yamanaka	Office Things, Inc.
Tom Ohta	Honolulu Community College, Hawaii
Mary Dang	Honolulu Community College, Hawaii
Dave Funsch	Inspector General Office, San Francisco, California
Bert Goodrich	Honolulu, Hawaii
Father Peter Salmas	Greek Orthodox Church Saints Constantine and Helen
Raymond Lenaburg	FEMA, San Francisco, California
M. Iwatake	Defense Investigation Service, Hawaii
Kelly C. Sandy II	Western Administrative Support Center, NOAA, Seattle, Washington
William J. Wiley	Honolulu Community College, Hawaii
Leny Acosta	Dictaphone Co.



Gerry Dohler outlines the area to be covered by a future Regional Tsunami Warning Center. The IOC/IHO GEBCO chart was presented to ITIC by the Canadian Hydrographic Service in late 1982.

F L A S H B U L L E T I N

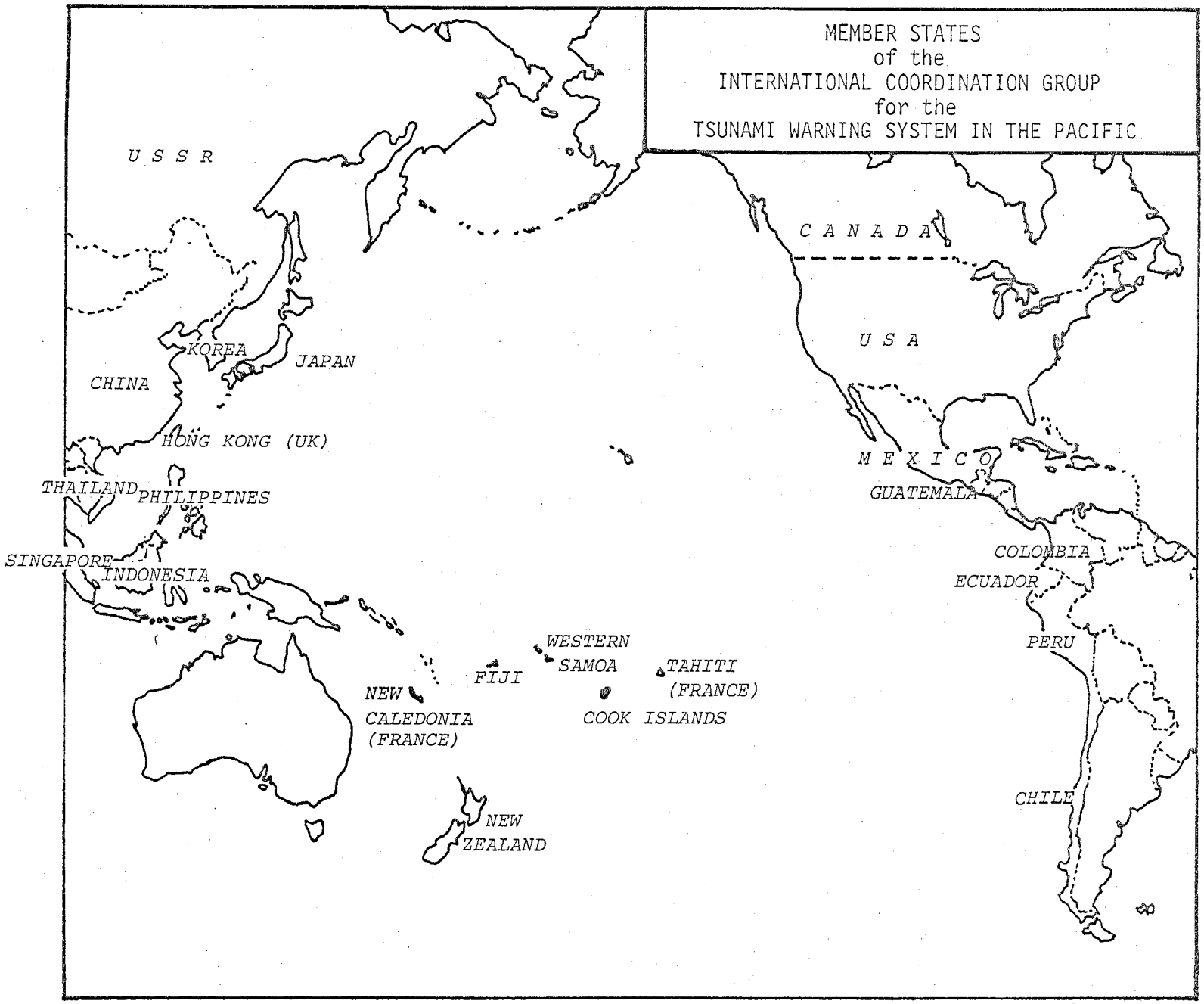
MAJOR TSUNAMI IN JAPAN - 25 MAY 1983

A severe earthquake measuring 7.8 on the Richter scale occurred on the northern part of the Sea of Japan, along the northwest coast of Honshu at 0300 Greenwich time on 25 May 1983. The earthquake epicenter was at 40.5 N, 139.0 E in the Sea of Japan. Reports conflicted on the size of the tsunami, but waves as high as 20 feet were reported along a 180-mile stretch of coast, killing 47 people and leaving 67 other people missing and feared dead. 159 boats were destroyed. The Japan Meteorological Agency issued a tsunami warning and so did the South Korean Central Meteorological Office. At the town of Akita on the north west coast of Honshu, waves of 10 feet high were reported.

The National Police Agency in Japan reported that about 50 people, including more than 40 children on a school excursion, were caught in a wave that struck Oga Peninsula, near the city of Akita, the state capital. In Akita police reported that 2 students were killed and 11 were missing. Officials also reported 14 dead throughout the prefecture, most of them fishermen or construction workers along the beaches.

The earthquake itself resulted in fires of an oil refinery and a thermal power plant in Akita, a city of 200,000, and other fires in Hirosaki city, north of Akita. At Niigata, 3 oil storage tanks were ruptured, although the city is 160 miles south of Akita. Structural damage and broken roads and sidewalks were reported in many parts of the area. Numerous highways were closed and train service was interrupted. Three workmen were swept away while working on sea barriers at Aomori, at the northern tip of Honshu. A number of smaller aftershocks, as many as ten, were reported within an hour after the main event.

ITIC is in the process of investigating the accuracy of the reports and a final report will be provided in the next issue of the Newsletter.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